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IRIG STANDARD 251-80
(FORMERLY 103-80)

IRIG STANDARD FOR PULSE REPETITION FREQUENCIES AND REFERENCE OSCILLATOR FREQUENCY FOR C-BAND RADARS

ELECTRONIC TRAJECTORY MEASUREMENTS GROUP
INTER-RANGE INSTRUMENTATION GROUP
RANGE COMMANDERS COUNCIL

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FOREWORD

This standard was written to accommodate C-band instrumentation radars. Interrange operations make the standardization of radar reference oscillator and operating pulse repetition frequencies a requirement for collecting and reducing data received from other ranges. When such data are obtained by instrumentation radars for target acquisition and/or target handover on interrange operations, they must be reduced and updated by computer to be immediately useful or valid. By applying this standard, many of the data reduction problems which currently exist will be alleviated. Personnel at the various radar complexes adhering to this standard will have the capability of receiving data from one another which is suitable for reduction, updating and immediate utilization. Most importantly, compliance with the provisions in this standard will assure interrange compatibility.

STANDARD

1. REFERENCE OSCILLATOR FREQUENCY

A. A Reference Oscillator Frequency of 81,964.270 Hertz and multiples thereof will be the standard.

B. Derivation

With a velocity of propagation (C) in a vacuum of

$C = 299,792.5 \pm 0.4$ km/sec (IRE Vol. 46, July 58)

$C = 327,857,0\overline{64}^{*} \pm 4\overline{37}$ International yards/sec

Assuming that the radar calibration is exactly 2000 International yards per cycle, then

$$F_{(\text{Reference Oscillator})} = \frac{C \text{ yards per second}}{2 \times 2000 \text{ yards per cycle}}$$

$$= \frac{327,857,0\overline{64} \pm 4\overline{37}}{4000} = 81,964.2\overline{66} \pm 0.10\overline{9} \text{ Hertz}$$

The mean was rounded off from $0.26\overline{6}$ to 0.270 for this standard.

$$F_{(\text{Reference Oscillator})} = 81,964.270 \text{ Hertz.}$$

C. The initial frequency of the Reference Oscillator shall be set with an accuracy of $\pm$ 1 part in 10^{11} or better.

D. The long term instability of the Reference Oscillator shall be not greater than $\pm$ 5 parts in 10^{12} in one year. Short term instability not greater than $\pm$ 3 parts in 10^{11} "RMS deviation" for a one second averaging time.

*The bar over the final digits indicates nonsignificant figures which are carried in the calculations to prevent rounding errors.

2. PULSE REPETITION FREQUENCIES (PRFs)

A. Pulse Repetition Frequencies of 640, 320, 160 and 80 Hertz, counted down from 81,964.270 Hertz and multiples thereof, will be the standard.

B. Derivation

With a Reference Oscillator Frequency of exactly 81,964.270 Hertz,

STANDARD

$$PRF = \frac{F}{n} = \frac{\text{Reference Oscillator Frequency}}{\text{Division Factor of PRF Generators}}$$

$$= \frac{81,964.270}{128} = 640.3458 \cong 640 \text{ Hertz}^{*}, \; n = 2^7 = 128 = (16x8x1)$$

$$= \frac{81,964.270}{256} = 320.1729 \cong 320 \text{ Hertz}, \; n = 2^8 = 256 = (16x16x1)$$

$$= \frac{81,964.270}{512} = 160.0864 \cong 160 \text{ Hertz}, \; n = 2^9 = 512 = (16x8x4)$$

$$= \frac{81,964.270}{1024} = 80.0432 \cong 80 \text{ Hertz}, \; n = 2^{10} = 1024 = (16x16x4)$$

*The Pulse Repetition Frequency is to be identified to the nearest cycle (640.3458 = 640 Hertz).

3. REFERENCE OSCILLATOR FREQUENCY USED AT VARIOUS RANGES

The Reference Oscillator Frequencies used at various ranges are as follows:

Pacific Missile Test Center	81,964.27015	Hertz
Western Space and Missile Center	81,964.27000	Hertz
Eastern Space and Missile Center	81,964.26666	Hertz
White Sands Missile Range	81,964.27000	Hertz
Kwajalein Missile Range	5,245,713.	Hertz*
Tonopah Test Range	81,964.270	Hertz
Armament Division, Eglin AFB, FL	41,965,706 ± 25	Hertz**

*This frequency is counted down to 81,964.27 Hertz.
**This frequency is counted down to 81,964.27 ± 0.05 Hertz.